Utility Mapping & Benchmarking

Texas Technology Showcase

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Houston TX

Session A4: Organizational and Managerial Aspects of Your Plants Energy-Efficiency Program

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Problem: Many plant utility personnel would like

(a) a better understanding of their energy cost structure, and
(b) to know where to focus an energy savings program.

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Project Objective: Develop a tool to help identify:

(a) the cost of all energy sources being supplied to a plant,
(b) how much energy is being consumed by the individual utility services and,
(c) opportunities to realize savings.

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Project Team: Industry/DOE/OIT Collaboration

Leads: Dupont, Reilly Industries

Companies: BASF, Dow, Celanese, Rohm & Haas, Millennium

Other: EPRI

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Project Team Responsibilities:

1. Create the framework and desired functionality of the tool
2. Issue RFQ based on rough prototype of tool
3. Help select RFQ awardee
4. Act as a steering team for project
5. Undertake to beta test tool

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Project Status:

1. Tool frame work and functionality defined
2. Prototype developed
3. RFQ issued (December, 2002)
4. Awardee selected (March, 2003)
5. Beta test version release (Summer 2003)

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Tool Framework and Functionality based on Prototype

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Tool addresses five basic questions:

1. What's my energy bill?
2. How are heat and power generated and/or supplied and where is it going?
3. Where's my energy going?
4. What energy applications are my best cost savings opportunities?
5. What resources and tools are available for me to address these opportunities?

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Input is needed to answer these questions

but …….

Data collection requirements are "layered" so that effort is targeted on areas identified as having potential savings

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Tool uses MECS[1] survey results as a first past estimate of energy flows and distribution

(1)

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1) **What's my energy bill?**

Inputs : One year's worth of monthly energy bills (fuel, steam and electricity) capturing costs of energy consumed and any credits for energy exported; production rate if known.

Output: Energy use in $ and Btu's and per pound of production, if this data is available as well as a first pass estimate of the consumption of this energy by individual utility service for a "typical" utility.

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2) **How are heat and power generated and/or supplied and where is it going?**

Input: Configuration of the utility plant (i.e. what services does it have and how are they driven?).

Output: Amounts of fuel, electricity and steam being used by utility - pumps, compressors, cooling, refrigeration, fans, etc.- based on a "typical" utility plant.

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3) **Where's my energy going?**

Inputs: Same as above plus any data on total connected load for any of the services.

Outputs: An improved estimate of the energy flows within the utility. If all connected loads are available the tool will check the energy balance using standard estimates for internal losses and alert the user to significant miss matches that will indicate either input data errors or losses significantly higher than typically encountered.

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4) **What energy applications are my best cost savings opportunities?**

   Input: None required; the tool provides some first-pass estimates. To refine these estimates "scorecards" can be completed for the services which offer the most potential for improvement. The scorecards help to provide a better estimate of savings and a sense of how the utility practices stack up against industry best practice.

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5) **What resources and tools are available for me to address these opportunities?**

This section of the tool contains a list of resources that the user would find valuable in implementing an energy savings program.

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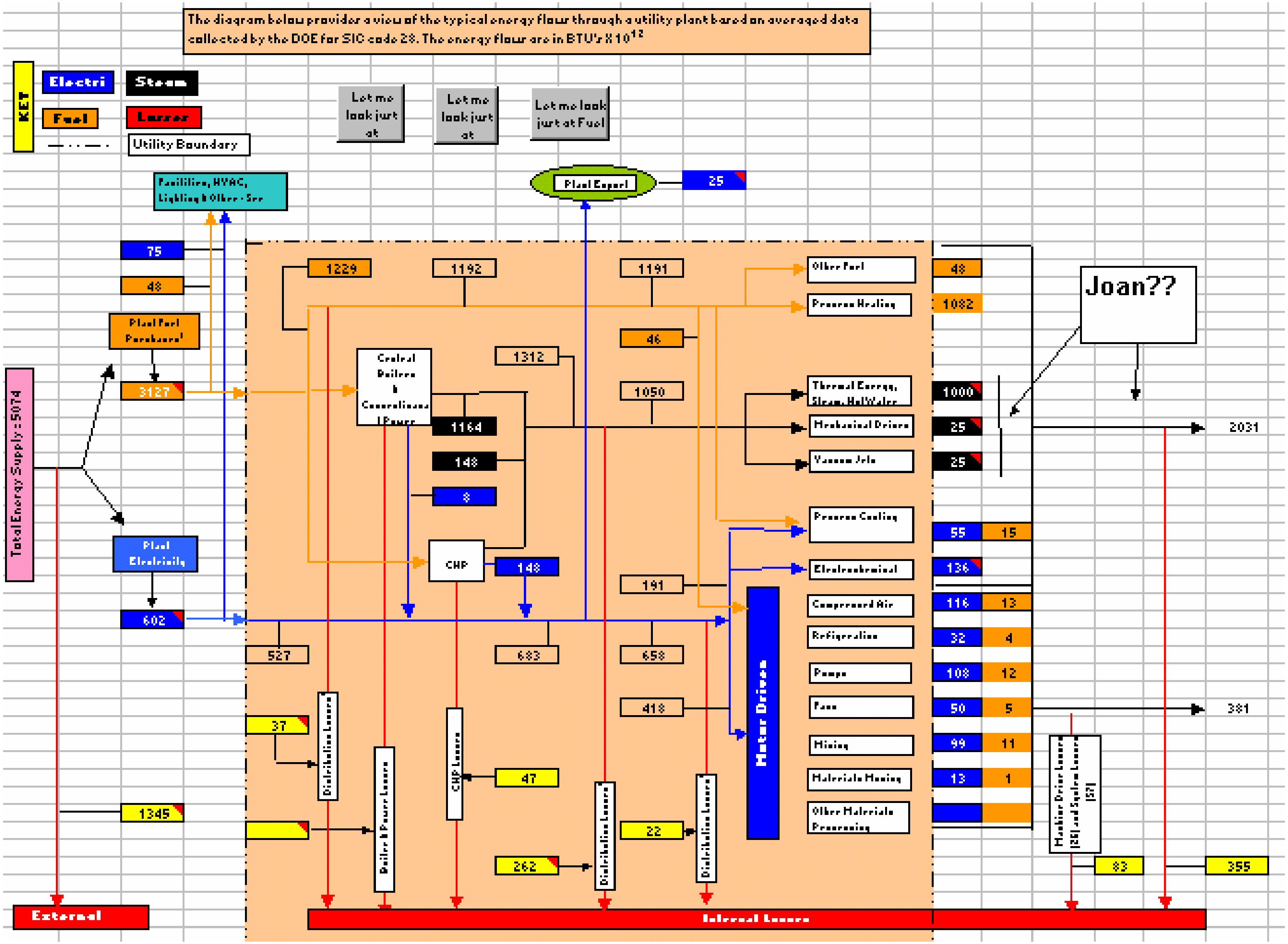
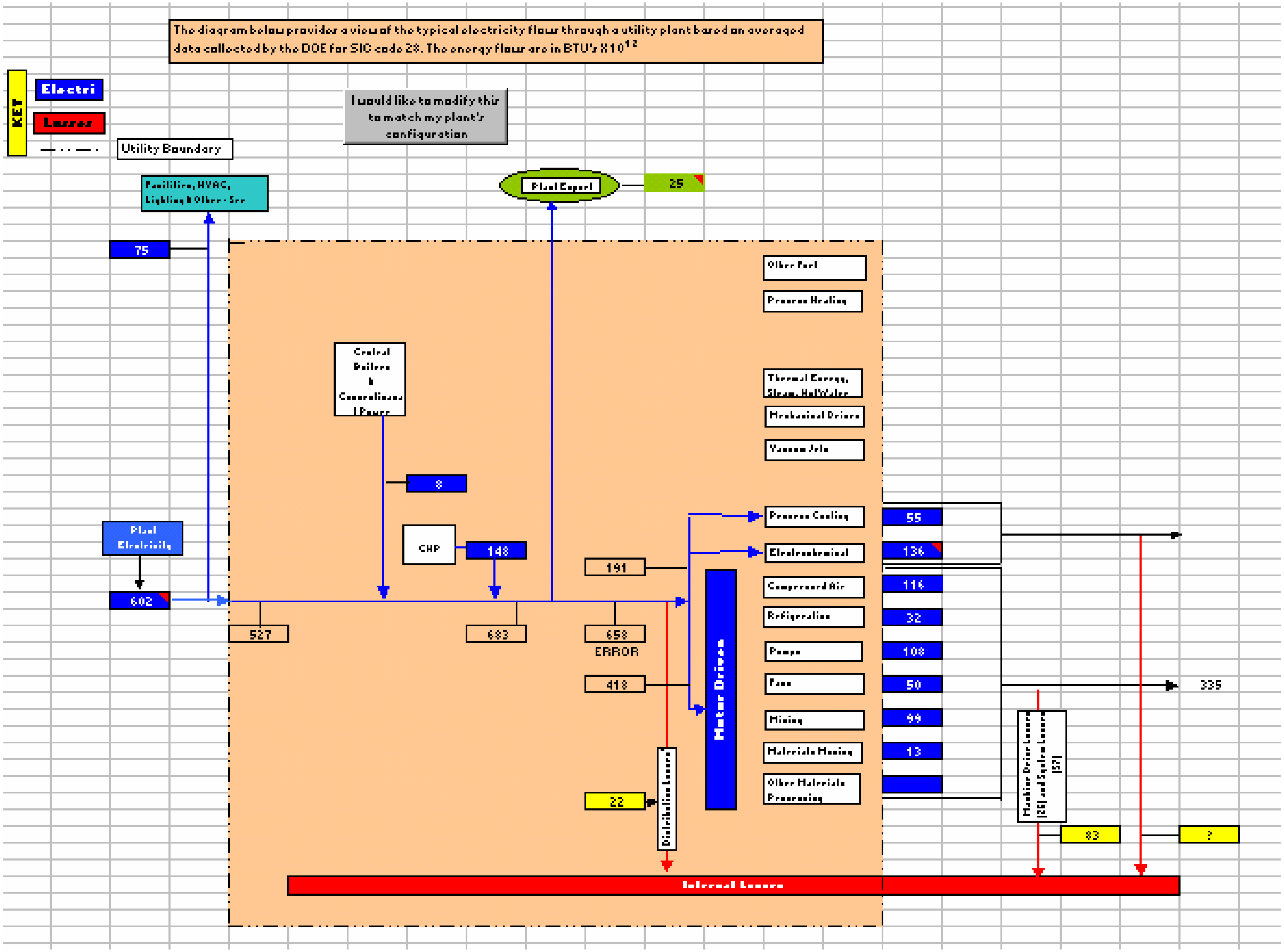
Some screen shots from prototype………



The diagram below provides a view of the typical energy flow through a utility plant based on averaged data collected by the DOE for SIC code 28. The energy flow are in BTU's X 10^12
KEY
Electri
Steam
Fuel
Losses
Utility Boundary
Let me look just at
Let me look just at
Let me look just at Fuel
Plant Export
25
Facilities, HVAC, Lighting & Other - See
75
48
Plant Fuel Purchases
3127
Total Energy Supply: 5074
Plant Electricity
602
1345
External
1229
1192
1191
46
1312
1050
Central Boilers & Cogeneration / Power
1164
148
8
CHP
148
191
527
683
658
418
37
47
22
262
Distribution Losses
Boiler & Power Losses
CHP Losses
Motor Drives
Other Fuel
Process Heating
Thermal Energy, Steam, Hot Water
Mechanical Drives
Vacuum Jets
Process Cooling
Electrochemical
Compressed Air
Refrigeration
Pumps
Fans
Mixing
Materials Moving
Other Materials Processing
48
1082
1000
25
25
55
15
136
116
13
32
4
108
12
50
5
99
11
13
1
Joan??
2031
381
83
355
Internal Losses



The diagram below provides a view of the typical electricity flows through a utility plant based on averaged data collected by the DOE for SIC code 28. The energy flows are in BTU's X 10^12
KEY
Electri
Losses
Utility Boundary
I would like to modify this to match my plant's configuration
Facilities, HVAC, Lighting & Other - Ser
Plant Export
25
75
Central Boilers & Conventional Power
8
Plant Electricity
CHP
148
602
527
683
191
658
ERROR
418
22
Distribution Losses
Motor Driven
Other Fuel
Process Heating
Thermal Energy, Steam, Hot Water
Mechanical Drives
Vacuum Jets
Process Cooling
Electrochemical
Compressed Air
Refrigeration
Pumps
Fans
Mixing
Materials Moving
Other Materials Processing
55
136
116
32
108
50
99
13
335
Machine Driver Losses [28] and System Losses [57]
83
?
Internal Losses

This worksheet allows you to enter your Electricity bill data

Please enter your monthly electrical bills for as many months as you wish in the shaded boxes below. For record keeping purposes you should also enter the year for which this data is applicable. Also indicate what units you use to purchase the electricity by checking the appropriate box below. Your average usage over the time period you selected will be calculated, converted to Btu's and entered in the worksheet **"My Electricity"**

(Indicates cells that must be filled in by user)

I purchase electricity in the following units

Kilo-watt hours ☑ Check Box 3

(Note: there may be other units for purchasing electricity which may need to be included here)

YEAR	
January	100
February	200
March	300
April	400
May	
June	
July	
August	
September	
October	
November	
December	

Electricit

Return to "My Electricity" worksheet

Average Usage 250 (Note: this calculates the average of however many months are entered)

Average Usage (MBtu's) 0.853 (Note: above average must be converted to a common unit for all energy inputs - millions of Btu's)

Average Production Rate (over same period) 100,000 MM lbs. (millions of lbs.)

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My Electrical Load

The electrical load is estimated based on a determination of all connected motors in each of the services and their load factor. If you do not have a motor management system it is suggested that you just count connected motors in each service with a HP rating of 100 or more, or just the top 10-15% based on size (typically this will cover 70-80% of all motor energy use). This data should be entered in the appropriate Input box **below** the Summary Table - this will allow you to document your work. If you wish to refine your data you can add smaller motors as appropriate. **The load factor you use should account for both installed redundancy and operating time; for example, if two fans are installed in a system but only one is run at a time and the system operates at 80% of the time the load factor is 0.5 times 0.8 = 0.4**

SUMMARY - This information is based on the data entered below for each service

Approximate installed capacity of motors by equipment type:	**Total HP**	**Est.**	**Eq.**
Air compressors	10,225	2,580	6.565
Refrigeration	5,325	1,310	3.333
Pumps	8,225	3,080	7.837
Fans/blowers	1,225	330	0.840
Mixers	1,725	680	1.730
Other, etc.....	425	130	0.331
All motors	27,150	8,110	20.636

Take me back to "My Electricity" worksheet

Air Compressors Motor Summary

Service	Motor ID	HP	Spare (Y/N)	On-Stream time	Est. Load
Tire pump	101A	5000	N	50%	2,500
	101B	5000	Y	50%	0
	202A	100	N	80%	80
	306	125	Y	75%	0
					0
					0
					0
					0
					0
					0
					0
					0

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Utility Mapping & Benchmarking Scorecards

SUMMARY Of Potential Steam Improvement Opportunities		
9/4/02		
	ANSWER	YOUR IMPROVEMENT OPPORTUNITY (% of fuel bill)
STEAM TRAP MANAGEMENT PROGRAM		0%
STEAM SYSTEM WATER TREATMENT PROGRAM		0%
STEAM SYSTEM INSULATION		0%
STEAM SYSTEM MAINTENANCE AND TESTING		0%
BOILER EFFICIENCY IMPROVEMENTS		0%
COMBINED HEAT AND POWER SYSTEM IMPROVEMENTS		0%
CONDENSATE RECOVERY SYSTEM IMPROVEMENTS		0%
MINIMIZE VENTED STEAM		0%

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Utility Mapping & Benchmarking References

- Case Studies
- Tip Sheets
- Guides
- Reports
- Website links